Moderate Prenatal Alcohol Exposure and Psychomotor Development at Preschool Age

ABSTRACT

Objectives. This study investigated the effect of moderate prenatal alcohol exposure on psychomotor development of preschool-age children in a longitudinal study.

Methods. Pregnant women were interviewed about their alcohol consumption at their first visit to the maternity hospital in Roubaix, France. Alcohol consumption before pregnancy and during the first trimester was assessed with a structured questionnaire. The psychomotor development of 155 children of these women was assessed with the McCarthy scales of children's abilities when the children were about 4½ years old.

Results. Consumption of 1.5 oz of absolute alcohol (approximately three drinks) or more per day during pregnancy was significantly related to a decrease of 7 points in the mean score on the general cognitive index of the McCarthy scales, after gender, birth order, maternal education, score for family stimulation, family status, maternal employment, child's age at examination, and examiner were controlled for.

Conclusions. This study showed that moderate to heavy alcohol consumption during pregnancy, at levels well below those associated with fetal alcohol syndrome, has effects on children's psychomotor development. (*Am J Public Health.* 1995;85:1654–1661)

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Introduction

The effects of high amounts of prenatal maternal alcohol consumption on the child were first described in 1968 by Lemoine et al.[1] In 1973, Jones and Smith[2] introduced the expression "fetal alcohol syndrome," and in the early 1970s, several researchers started to investigate the toxic effects of alcoholism during pregnancy on child development.[3] Characteristics of fetal alcohol syndrome include growth retardation, central nervous system dysfunction, and a characteristic pattern of facial features (generally defined by short palpebral fissures, an elongated midface, a long and flattened philtrum, and thin upper lip), and it has been observed in children of alcoholic mothers.[4] For these children, the most damaging long-term consequence is their impaired mental development, which can go from subtle cognitive dysfunction to severe mental retardation.[5]

In 1976, a possible effect of moderate alcohol consumption—in the range of 1.5 oz of absolute alcohol per day—on outcome of pregnancy was examined, and an association was found with a decrease in birthweight.[6] Most studies on the effect of alcohol on pregnancy conducted after 1976 showed similar results.[7] The hypothesis that moderate alcohol consumption affects the developing central nervous system of the fetus was first investigated in Seattle by Streissguth et al.,[8] who initiated a long-lasting follow-up study. They observed an association with motor and mental development, vigilance, and attention at various ages.[9] A few other cohort studies were set up to investigate this hypothesis, but up to now results remain inconsistent.[10–14] These studies were mainly conducted in samples of mothers with very low alcohol consumption and sometimes in populations among whom alcohol drinkers may also have been exposed to illicit drugs. In utero exposure to these illicit drugs is also suspected to have long-term effects on child development.[15]

In fetal alcohol syndrome, central nervous dysfunction is observed in different areas: mental retardation (performance functions being more depressed than verbal functions), learning difficulties, and deficit in memory. Motor function is also impaired, especially with respect to fine motor tasks.[16] Experimental animal studies have shown that prenatal alcohol exposure may result in developmental anomalies of sensorimotor as well as cognitive functioning.[17]

The hypothesis of our study is that moderate alcohol consumption in pregnancy will have effects on the functioning of the central nervous system in childhood; the present article focuses on the psychomotor development of preschool-age children in a population that includes a high proportion of mothers who drink various amounts of alcohol and who do not consume illicit drugs.

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Methods

Population and Measure of Alcohol Consumption

Women of French origin who had their first contact with the obstetric department of the public hospital of Roubaix between May 15, 1985, and January 15, 1986, were included.[18] Among the 782 women satisfying these criteria, 698 were successfully interviewed; 684 were interviewed at their first prenatal visit in the hospital, which occurred during the second trimester for the majority of the women. Fourteen women who delivered in this hospital during this 8-month period but had no hospital prenatal care were interviewed during their postnatal stay. This latter group, although interviewed retrospectively, was entered in the study because mothers with no hospital prenatal care usually include a high proportion of heavy drinkers.

Alcohol consumption was determined for the first trimester of pregnancy and the period before pregnancy. The interviews were conducted with a structured questionnaire, in which alcohol consumption was assessed by the number of glasses of beer, wine, and stronger alcoholic beverages consumed daily on weekdays and weekends. Alcohol consumption was calculated as the number of glasses of alcoholic beverages consumed weekly. A glass was estimated to contain about 0.5 oz of absolute alcohol, whatever the drink. The hospital is located in an area of low socioeconomic status and high alcohol consumption; the alcohol consumed in this population is mainly beer.

A subsample of 347 women, stratified on the mother's alcohol consumption before pregnancy, was selected for further investigations such as biologic assays[19] and morphologic examination at birth.[18] This subsample deliberately overrepresented women with high levels of alcohol consumption.[18] Among this subsample, 326 gave birth to singleton babies at the hospital in Roubaix. The publication of the first results on the long-term consequences of moderate alcohol consumption[20] led us to decide to follow up the children in this subsample at 4½ years of age. Eight children were excluded from the follow-up because their mothers were known as alcohol abusers by the obstetric team but had declared very low or no alcohol consumption, and three were excluded because data on the mother's alcohol consumption during the first trimester of the pregnancy was missing. For practical reasons, the follow-up had to be limited to the 240 children still located in the area of Roubaix. Twenty-seven families declined the follow-up assessment and 53 never showed up at the clinics; 160 children participated in the follow-up.

During the assessment, five children refused totally or partially to participate in the test of psychomotor development. Thus, the results presented in this article include 155 children; 41 of their mothers had been interviewed in the first trimester, 80 in the second, 28 in the third, and 6 after birth.

Assessments

It had been planned that the children would be examined at the age of 4½ years ± 2 months, but for practical reasons some children were assessed slightly later, mainly in families who were difficult to locate or to motivate. The investigations were carried out by the medical doctors and psychologists of the seven clinics of Maternal and Child Health (Protection Maternelle et Infantile) covering the area of Roubaix and its surroundings.

The psychologist tested the child's psychomotor development and interviewed the parents on the sources of stimulation for the child at home. The medical doctor interviewed the parents on all medical and social questions and examined the child. The doctors and psychologists were unaware of the alcohol consumption of the mother.

Psychomotor development was assessed with the McCarthy scales of children's abilities.[21] The McCarthy scales include five subscales: verbal, perceptual performance, quantitative, memory, and motor. The general cognitive index includes the items of three subscales (verbal, perceptual performance, and quantitative). It reflects children's global cognitive functioning and has a mean score of 100 in the average population; the subscales have a mean score of 50. The test has been translated in French and standardized in France.[22]

Covariate Measures

Factors likely to confound the relation between alcohol and psychomotor development were assessed at various stages. Data on pregnancy and the child at birth were extracted from the maternity records. At the follow-up assessment, at 4½ years, parents were interviewed on the child's health, sleep or feeding disorders, problems at school, life events, and sociodemographic characteristics[23,24]; stimulation of the child at home was assessed by the psychologist using three subscales of the Home Observation for the Measurement of the Environment Scale[25]: language stimulation, academic stimulation, and variety of experimentations.

TABLE 1—Study Participants' Alcohol Consumption before Pregnancy and during the First Trimester

Oz Absolute Alcohol/Day	No.	%
Before pregnancy		
0	31	20
0.1–0.49	22	14
0.5–1.49	51	33
1.5–2.49	30	19
≥2.5	21	14
Total	155	100
First trimester		
0	48	31
0.1–0.49	25	16
0.5–1.49	50	32
1.5–2.49	21	14
≥2.5	11	7
Total	155	100

Analysis

Alcohol consumption was considered in two classes: 0 to 1.49 oz/day and 1.5 oz/day or more. This cutoff point for alcohol consumption was the one already used in the analysis of birth outcome in this study,[26] as in previous studies in France.[6] To simplify, we will use the term *heavy drinkers* for alcohol consumption of at least 1.5 oz/day and *light drinkers* for consumption of 0 to 1.49 oz/day. Then, a dose–response relationship was investigated, and alcohol consumption was considered in four classes (0–0.49, 0.5–1.49, 1.5–2.49, and ≥2.5 oz/day).

Multiple regression analysis was used to control for the confounders. Factors were included in the model if they are generally considered to be correlates of cognitive development or if they were associated with both general cognitive index scores and alcohol consumption in the first trimester in our study. The following covariates were included in the main model: birth order, maternal educational level, maternal employment at 4½

TABLE 2—Potential Confounding Variables and Their Association with First-Trimester Alcohol Consumption and Mean Scores on the General Cognitive Index of the McCarthy Scales

		First-Trimester Alcohol, %			Child's McCarthy General Cognitive Index Score		
	Total No.	<1.5 oz/day	≥1.5 oz/day	*P*	Mean	SD	*P*
Maternal and family characteristics at birth							
Mother's age, y							
≤19	13	92	8	.002	93.8	19.9	.64
20–24	46	85	15		100.8	18.0	
25–29	47	89	11		101.4	18.2	
≥30	49	61	39		100.9	20.7	
Birth order							
1	49	94	6	<.001	106.6	17.2	.007
2	38	71	29		98.3	17.0	
3	30	90	10		102.3	19.2	
≥4	38	61	39		93.0	20.7	
Cigarettes per day during pregnancy							
0	108	89	18	.32	103.4	18.7	.01
1–9	26	81	19		93.0	17.3	
≥10	21	62	38		94.0	19.5	
Maternal and family characteristics at 4½ y							
Maternal educational level							
Primary	81	73	27	.03	92.1	17.2	<.001
Secondary	55	84	16		107.0	16.7	
Higher	18	100	0		118.3	13.4	
Mother presently employed							
No	95	76	24	.17	95.3	20.2	<.001
Yes	60	85	15		108.5	13.8	
Present/most recent maternal occupation							
Manual worker	72	76	24	.39	94.8	15.9	<.001
Clerical worker	47	83	17		104.7	20.8	
Other	25	88	12		113.8	15.1	
Mother living with child's father							
No	28	75	25	.54	94.8	20.8	.08
Yes	126	80	20		101.8	18.4	
Family status							
Mother living alone	22	77	23		93.8	18.8	
Mother living with father or companion				.03			<.001
Unemployed	18	56	44		86.1	10.7	
Employed	112	83	17		103.8	18.5	
Score for family stimulation[a]							
≤14	35	71	29	.18	84.2	14.9	<.001
15–18	66	77	23		100.4	16.9	
≥19	54	87	13		110.9	16.5	
Child characteristics							
Gender							
Male	75	81	19	.56	101.7	19.6	.42
Female	80	77	23		99.2	18.5	
Birthweight, g							
<2500	10	70	30	.45	103.5	18.4	.60
≥2500	145	80	20		100.2	19.1	
Age at examination, mo							
≤53	39	90	10	.07	108.4	17.4	.001
54–56	67	81	19		100.6	19.6	
>56	49	69	31		93.7	17.1	

[a]This score was obtained with three subscales extracted from the Home Observation for Measurement of the Environment Scale.[25]

years, family status (mother living alone, living with an employed companion, or living with an unemployed companion), score for family stimulation, gender, age of the child at examination, and examiner. Two other models were also considered, including, respectively, tobacco consumption during pregnancy and birthweight. Tobacco consumption in pregnancy has been suspected to have a deleterious effect on cognitive development,[27] and a low birthweight can also be a risk factor for impaired cognitive development.[23] The same models were used for the general cognitive index and for the five subscales. All analyses were carried out with SAS software[28] at the INSERM National Computer Center (Villejuif).

Results

The 160 children who came to the assessment were compared with the 81 children who did not participate. There were no significant differences for maternal alcohol consumption before pregnancy or during the first trimester, maternal tobacco consumption, or sociodemographic variables such as maternal educational level, age, birth order, and birth outcome.

Alcohol Consumption and Other Characteristics

Levels of drinking before and during the first trimester of pregnancy are shown in Table 1. Alcohol consumption during the first trimester was lower than consumption declared before pregnancy. Heavy drinking ($\geq$ 1.5 oz/day) was related to an older age, a high parity, a low level of education, and unemployment of the companion (Table 2). Numerous mothers of children assessed late were heavy drinkers. Although not significant, there was a trend for heavy drinking to be associated with heavy cigarette smoking, maternal unemployment, a lower score for family stimulation, and a lower birthweight.

Since birth, parents of 25 children had separated. Half of the subjects had moved to another house since birth; these variables were not related to alcohol consumption. Health status of the child reported by the parents was not related to maternal alcohol consumption during pregnancy.

Psychomotor Development

In our sample, the mean score on the general cognitive index of the McCarthy scales was 100.4, with a standard deviation of 19.0. Figure 1 shows the distribution of general cognitive index scores among children of mothers consuming less than 1.5 oz/day of absolute alcohol and among children of mothers consuming 1.5 oz/day or more of absolute alcohol. The crude data (Table 3) showed a significant relation between alcohol consumption during pregnancy and the general cognitive index, verbal, performance, and quantitative scale scores. When alcohol consumption was considered in four classes, a trend was significant or nearly significant for all scales except the memory and motor scales. Scores on the memory and motor scales were not related to alcohol consumption during pregnancy. For consumption before pregnancy, the relations were the same, although less significant.

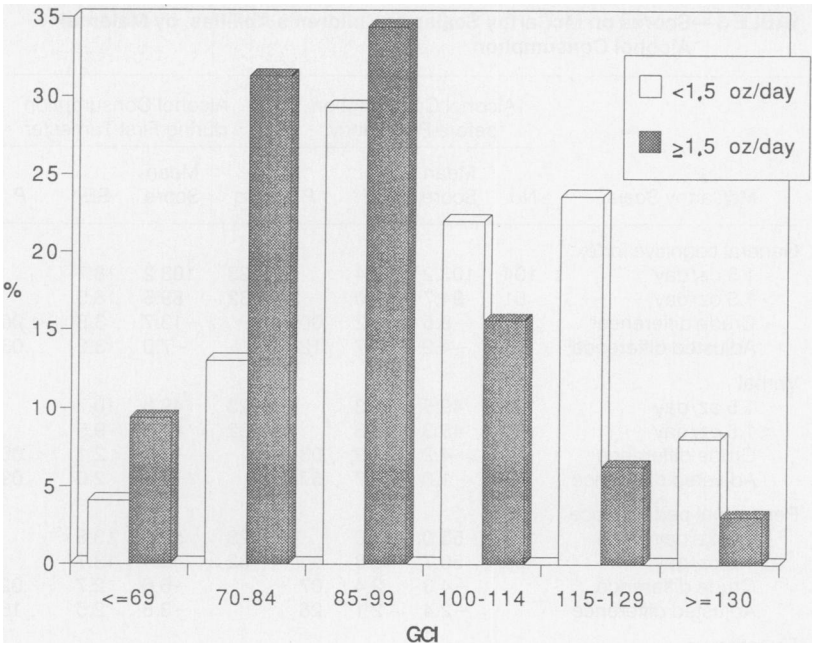

FIGURE 1—Distribution of general cognitive index (GCI) scores among children of mothers drinking less than 1.5 oz/day of absolute alcohol during pregnancy and among children of mothers drinking 1.5 oz/day or more of absolute alcohol during pregnancy.

Scores on the general cognitive index were related to birth order. All variables characterizing the sociocultural level of the mother and father or present companion (educational level, occupational activity, family status) were strongly related to general cognitive index scores in the expected direction, as was the score for family stimulation (Table 2). In unadjusted regression analysis, maternal level of education and family stimulation accounted respectively for 25% and 27% of the variance in the general cognitive index scores. These two characteristics were highly related. Cigarette smoking during pregnancy was associated with a lower score on the general cognitive index. Children assessed older had a lower general cognitive index score than those assessed younger. Birthweight, gender, health problems, and life events were not significantly related to general cognitive index score.

After controlling for confounders (Table 3), the mean general cognitive index score was 7 points lower for children whose mothers were heavy drinkers during pregnancy than for children whose mothers were light drinkers during pregnancy; the R^2 of the model was 0.50. The quantitative scale was also significantly related to alcohol consumption during the first trimester of pregnancy. For the performance and verbal subscales, the trend was the same. The relation between alcohol consumption before pregnancy and the quantitative scale score remained significant, but not the relation with the general cognitive index score.

Other models of multiple linear regression were assessed, including tobacco use and birthweight, excluding the six children whose mothers were interviewed after birth: the relation between general cognitive index score and alcohol consumption was only slightly modified. When alcohol consumption during the first trimester was considered in four classes, the difference in general cognitive index score compared with the 0 to 0.49 oz/day class was +4.7 for the 0.5 to 1.49 oz/day class, −8.2 for the 1.5 to 2.49 oz/day class, and +2.9 for the 2.5 oz/day or more class.

Discussion

Children of mothers who consumed 1.5 oz of absolute alcohol (three drinks) or more per day during pregnancy had significantly poorer psychomotor development than the children of mothers who consumed less alcohol, after controlling for birth order, maternal educational

TABLE 3—Scores on McCarthy Scales of Children's Abilities, by Maternal Alcohol Consumption

McCarthy Scale	Alcohol Consumption before Pregnancy: No.	Mean Score	SE	P	Alcohol Consumption during First Trimester: No.	Mean Score	SE	P
General cognitive index								
<1.5 oz/day	104	103.2	19.4		123	103.2	18.7	
≥1.5 oz/day	51	94.7	17.0		32	89.5	16.5	
Crude difference[a]		−8.5	3.2	.009		−13.7	3.6	<.001
Adjusted difference[b]		−4.2	2.7	.12		−7.0	3.2	.03
Verbal								
<1.5 oz/day	104	49.5	11.3		123	49.8	10.7	
≥1.5 oz/day	51	45.3	9.6		32	41.9	9.5	
Crude difference		−4.2	1.9	.03		−7.9	2.1	<.001
Adjusted difference		−1.0	1.7	.57		−3.4	2.0	.09
Perceptual performance								
<1.5 oz/day	104	55.0	14.0		123	55.0	13.8	
≥1.5 oz/day	51	50.7	13.8		32	48.4	13.7	
Crude difference		−4.3	2.4	.07		−6.6	2.7	.02
Adjusted difference		−2.4	2.1	.26		−3.6	2.5	.16
Quantitative								
<1.5 oz/day	104	51.0	10.7		123	51.0	10.2	
≥1.5 oz/day	51	47.0	9.5		32	44.8	10.3	
Crude difference		−4.0	1.8	.02		−6.2	2.0	.003
Adjusted difference		−4.4	1.8	.02		−5.5	2.1	.01
Memory								
<1.5 oz/day	103	49.3	11.5		123	49.3	11.0	
≥1.5 oz/day	51	46.5	9.3		31	45.0	9.8	
Crude difference		−2.8	1.9	.13		−4.3	2.2	.05
Adjusted difference		+0.5	1.7	.78		+0.1	2.1	.95
Motor								
<1.5 oz/day	103	58.4	12.8		123	58.2	12.4	
≥1.5 oz/day	51	56.0	11.4		31	55.2	12.2	
Crude difference		−2.5	2.1	.25		−3.1	2.5	.22
Adjusted difference		−1.6	2.1	.45		−1.2	2.6	.65

[a]Crude difference of the scales between children of mothers consuming 1.5 oz/day or more of absolute alcohol and children of mothers consuming less than 1.5 oz/day of absolute alcohol.
[b]Adjusted difference of the scales between children of mothers consuming 1.5 oz/day or more of absolute alcohol and children of mothers consuming less than 1.5 oz/day of absolute alcohol. The difference was adjusted for birth order, maternal educational level, present maternal employment, family status, score for family stimulation, gender, age of the child at examination, and examiner.

level, maternal employment, family status, score for family stimulation, gender, age of the child at examination, and examiner. The relations were weaker for alcohol consumption before pregnancy than during pregnancy. This study is the first to confirm the effect on preschool-age children of moderate to heavy maternal drinking found by Streissguth et al.,[20] in a population with predominantly low socioeconomic status and no use of illicit drugs.

The high percentage of children lost to follow-up can be explained by the lack of contact with the mother between birth and the age of 4½ years, especially in a population of low socioeconomic status. For data available at birth, no differences were found between children who participated in the follow-up and those who did not. However, self-selection linked to both maternal alcohol consumption and child development cannot be completely ruled out. The available data do not indicate that the most affected children of the heaviest drinkers might be overrepresented among those lost to follow-up, yet this hypothesis cannot be completely rejected. Our findings are based on a small number of children heavily exposed prenatally to alcohol; however, their level of exposure was higher than that in most previous studies in the literature, except the one by Streissguth et al.[9]

Alcohol consumption was assessed by interview. Pregnant women may tend to underestimate their drinking, but currently there are no biologic markers available for moderate alcohol consumption. A detailed interview on alcohol consumption including questions about frequency, nature, and number of drinks gives the best estimates of alcohol consumption.[29]

Children exposed to 2.5 oz/day or more of alcohol even had slightly better results on the general cognitive index than children exposed to 1.5 to 2.49 oz/day. This result was unexpected and might be at least partly explained by misclassification on alcohol consumption, which can disturb the detection of a dose–response relationship,[30] and by the small number of children with the highest level of exposure.

As the study was prospective, except for six cases, declaration of alcohol consumption was not biased by the children's health status. Excluding these six children only very slightly decreased the difference in general cognitive index scores between children of heavy and light drinkers.

Part of the effect on development attributed to prenatal alcohol exposure might be the result of characteristics associated with heavy maternal drinking. Controlling for confounders decreased the difference in general cognitive index scores between children of heavy and light drinkers. Two factors were highly related to general cognitive index scores: family stimulation of the child and level of education of the mother. Stimulation of the children at home is strongly related to psychomotor development.[25] Although the level of stimulation provided to a child can be affected by the responsiveness of the child, which may itself be influenced by prenatal alcohol exposure, this variable was taken into account in the analysis. This conservative approach may have led to underestimating the effect of alcohol, but the analysis excluding family stimulation did not lead to a larger estimation of the alcohol effect.

A limitation of the study is that the mother's IQ was not measured, because it seemed difficult to see measurement of IQ as acceptable in France. However, level of education and IQ are highly related; and, like maternal IQ, maternal level of education is highly predictive of children's 4-year IQ.[30] Most studies in this area, such as the Seattle study,[9] only use parents' level of education in their models.

In our model, we controlled for birth order. When the number of siblings at the age of assessment was taken into account, results were very slightly modified.

Because we found that mean general cognitive index scores varied according to the examiners, this variable was entered in the model. However, the examiners were assigned to various geographic areas, which differed on most social characteristics as well as on the level of maternal alcohol consumption; these geographic differences may explain some of the differences in general cognitive index scores among examiners. When this variable was not included in the model, the mean difference in general cognitive index scores according to alcohol consumption was not appreciably modified (adjusted difference = $-6.3, P < .05$).

Age at examination (56 ± 2.7 months) was taken into account, as it increased with the level of alcohol consumption of the mother during pregnancy; children examined at an older age were those whose parents were more difficult to reach, a characteristic that may be related to the level of alcohol consumption. The general cognitive index scores were not related to birthweight, and the relation between alcohol and general cognitive index scores remained significant even after taking birthweight into account. Thus, the association of psychomotor development with prenatal alcohol exposure is not simply mediated by a lower birthweight due to in utero alcohol exposure. In our sample, tobacco use was not significantly related to alcohol consumption of the mother. However, because of a suspected relation between smoking in pregnancy and later child development,[27] tobacco use was added to the model, without changing the relation between alcohol and the general cognitive index scores.

These results are consistent with those observed in animal experiments, in which impaired learning and developmental delay have been associated with prenatal alcohol exposure.[17,31]

Other studies have been conducted with the same hypothesis: that children of moderate drinkers would have deficits in the same areas as those observed in fetal alcohol syndrome, although they would be less affected.

The first study, already mentioned, was the Seattle Longitudinal Prospective Study on Alcohol and Pregnancy organized by Streissguth et al.,[8] in which 500 children of middle-class, married women were followed until 14 years of age.[32] In this cohort, at various ages (birth, 8 months, and 4, 7, 11, and 14 years), associations were found between alcohol use during pregnancy and indicators of central nervous system functions, mental and motor development, vigilance, and behavior.[9] At 4 years, there was a decrement of 5 IQ points in children of mothers drinking 1.5 oz/day or more compared with children of those drinking less[20]; at 7 years, there was a decrement of 7 IQ points in children of mothers drinking 1 oz/day or more.[33] At 11 and 14 years, a negative correlation between maternal alcohol consumption and academic performance, arithmetic, and language abilities was observed.[9]

A Canadian investigation followed 210 children at 1, 2, 3, 4, and 6 years of age.[10,34,35] This study found some associations between psychomotor development or language abilities and maternal alcohol consumption at 1 and 2 years, but they were no longer significant when the children were older. However, in this study, the level of maternal alcohol consumption was low; and in the 4-year sample, only four mothers consumed 1.5 oz/day or more during pregnancy.

In Detroit, Michigan, 45 children of mothers drinking at least 0.5 oz/day during pregnancy and 337 children of mothers drinking less than 0.5 oz/day during pregnancy were assessed at 13 months with Bayley scales.[36] These children were mainly Black and from families with low socioeconomic status. The incidence of a mental index lower than the 10th percentile was doubled in children whose mothers consumed at least 0.5 oz/day of alcohol. The psychomotor index was lower in children of mothers consuming 1 oz/day or more than in children of mothers consuming less than 1 oz/day.

Other studies did not find any association between moderate alcohol consumption in pregnancy and psychomotor development.[11,12] These studies were characterized by a low mean level of alcohol consumption and few children with at-risk exposure levels. In a large European study,[12] 1240 children were assessed at 18 months with Bayley scales; only 2.4% of the mothers stated that they drank 1 oz/day or more of alcohol, and there was no association between maternal alcohol consumption and child development. A cohort study from Cleveland, Ohio, in which about 300 children were assessed each year from 6 months to 4 years of age, found no association between maternal alcohol consumption and children's psychomotor development[11] or vigilance.[37] At 4 years, there were only six children whose mothers consumed more than 0.5 oz/day of alcohol.

In our study, weaker associations with alcohol consumption before pregnancy than with alcohol consumption during pregnancy were found, which seems consistent with the hypothesis of a direct toxic effect of alcohol. In the Seattle study,[9] stronger associations with child development were found for alcohol consumption before pregnancy was recognized than for alcohol consumption in midpregnancy. Alcohol consumption in early pregnancy can affect organogenesis. However, in humans, the period of brain growth spurt is the third trimester, and animal studies support human findings that third-trimester ethanol exposure may be more detrimental to human brain development than exposure at other times in gestation.[38] Third-trimester alcohol exposure was not measured for all women in our study, nor for all women in the Seattle study, but it is correlated with alcohol consumption during the first trimester and even with alcohol consumption before pregnancy. Two small studies[13,39] showed that stopping drinking in the third trimester of pregnancy was associated with better outcome than continuing until birth.

Our study took place in an area where women are mainly of low socioeconomic status and where alcohol consumption is high, and our sample overrepresented heavy drinkers to increase the power of the study. In the initial sample, representative of women delivering at Roubaix Hospital, 11% of the women stated that they drank at least 1.5 oz/day of alcohol. We did not find any effect below this level. This finding should not be interpreted as indicating a biologic threshold for an effect of alcohol on the fetus. In behavioral teratology, it has been hypothesized that anomalies of the central nervous system would appear at lower levels of exposure than would growth retardation.[17] However, the methodologic problems encountered in assessing exposure, child development, and the major role of the postnatal environment in child development may represent serious obstacles to the detection of effects at low levels of exposure.

Binge drinking has been found to be associated with poorer child performance.[9] Although we inquired about exceptionally heavy drinking, only four women mentioned it, and binge drinking is probably a rare behavior in the studied population.

In our study, the motor scale of the McCarthy scales was not related to maternal alcohol consumption. Heavy prenatal

alcohol exposure is associated with poor fine and gross motor function in children with fetal alcohol syndrome and children of alcoholic mothers,[2,5,16,40] with tremors, motor incoordination, weak grasp, poor eye–hand coordination, and slow motor performance time. Animal experimentation shows deficits in reflex development and tasks requiring balance and motor coordination.[17,41] As for mental development, the most significant results come from the Seattle cohort: motor problems were observed in relation to prenatal alcohol exposure at 8 months with the Bayley scales[9] and at 4 years with motor tests.[42] The Detroit study already cited also showed delay in motor development at a higher level of maternal alcohol consumption than that associated with mental effects.[36] In the other studies with Bayley[12,34] or McCarthy scales,[35] no relation was found between moderate maternal alcohol consumption and the motor subscales of the tests. In the Seattle study, anomalies of motor function were found with tests especially designed to investigate fine and gross motor functions.[42] The subscales of general developmental tests might not be specific enough to explore motor dysfunction due to prenatal alcohol exposure.

Conclusion

This study has shown effects of maternal alcohol consumption on the psychomotor development of preschool-age children. Interventions aimed at reducing alcohol consumption among pregnant women should not focus only on alcoholic mothers, because even lower levels of alcohol consumption can put the child at risk. □

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